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Toxicity of Alcide

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Key words: Alcide; LD_{50}; rat.

Alcide is now used as a liquid sterilizer in an ultrasonic cleaner. It is excellent for herpes, fungus of the fingernail, warts and treatment of burn infection. The active ingredients (AI's) in this compound are sodium chlorite (ClO_2^-) and lactic acid. Studies were conducted to determine the toxicity of Alcide in its liquid and gel forms. The oral lethal doses after 14 days (LD_{50}) in female and male rats were 340 and 292 mg kg^{-1} (AI), respectively. No mortality occurred during the acute dermal toxicity study. The ocular irritation study in rabbits indicated redness in the conjunctivae within 1 h which became normal after 24 h. The cornea and iris remained without changes during the observation period. The guinea pig sensitization study revealed the occurrence of reversible necrosis after 3 days. On day 11, healing began and was completed by day 15 after the intradermal injection. No significant changes were observed in red blood cell compartments, glutathione levels, hemolysis, methemoglobin and blood chemistry in rabbits treated daily with 0.5, 1.0 or 2.0 (gm kg^{-1}) Alcide for 1 month using intact and abraded skin.

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INTRODUCTION

Alcide is now used as a liquid sterilizer in an ultrasonic cleaner, and it deactivated most bacteria and viruses within 1 min at room temperature (US Patent, 1978). In the preliminary clinical trial,[1] a physician stated that Alcide induced prompt remission of perioral herpes symptoms and rapid resolution of the lesions in 15 of 16 cases. These patients have had no recurrence in 6 months. Also five of the six patients with genital herpes had prompt remission and no recurrence.[1] The internal primary report revealed that all herpes simplex virus types 1 and 2 (HSV 1 and 2) were destroyed *in vitro* after exposure to Alcide for 15 min.[2] A substantial improvement is produced in foot rot in sheep, mouth rot in snakes and rabbit ear canker. Also, in the case of undetermined skin lesions of chronic duration on horses and sheep (which appear to be fungal-like in nature), Alcide has been extremely effective, particularly in old chronic lesions where no other product has been useful.[3]

Chemical composition

Alcide is a combination of lactic acid and sodium chlorite. It is produced in liquid and gel forms (Table 1) (US Patent, 1978). The addition of equal amounts of part A and part B forms chlorine dioxide (ClO_2), which is a powerful oxidizing agent.

Toxicity of ClO_2 and ClO_2^-

Heffernan *et al.*[4] reported that the oral administration of ClO_2^- tablets decreased glutathione *in vivo* which was accompanied by an increase in hydrogen peroxide. Abdel-Rahman *et al.*[5] indicated that ClO_2 and ClO_2^- in drinking water decreased blood glutathione in rats after 2 months

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Table 1. Composition of Alcide

Alcide-Experimental Sterilant Liquid
Sodium chlorite (ClO_2^-) 79%
Tetrasodium EDTA
Lactic acid 88%
Pluronic F-68
Water
Alcide Experimental Sterilant Gel
ClO_2^- 79%
Tetrasodium EDTA
Lactic acid 88%
Pluronic F-68
Water
Gelling agent (magnesium, aluminium silicate)

treatment. However, some groups gradually adapted to ClO_2 stress with increased treatment time, as noted in a dose of 100 mg l^{-1} ClO_2 given to rats in drinking water daily for 4 months.

The studies described in this report were conducted to provide information on the toxicity of Alcide and its effect on the hematological parameters, glutathione level, methemoglobin and blood chemistry.

METHODS

Animal toxicology

Acute toxicity LD_{50}. *Oral route.* Sixty female and 59 male Sprague–Dawley rats were used for this experiment. Groups of female rats were administered Alcide liquid by gavage in doses which contained the following amounts of ClO_2^- as active ingredient (AI): 25.0, 56.8, 207.5, 250.0, 312.5,

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356.3, 425.0 and 625.0 mg per kg body weight. Other groups of male rats received the following doses: 18.0, 40.9, 149.4, 180.0, 225.0, 256.5, 298.8 and 450.0 mg per kg body weight. Gross signs of toxicity and mortality were recorded at 2, 24 and 48 h, and for 14 days after administration. The LD_{50} was generated by probit analysis. Gross necropsy was conducted on animals that died during the study. Body weight was recorded initially and at 7 and 14 days post dose. After 14 days, it was assumed that all survivors would continue to live.

Dermal route. Twenty-four New Zealand white albino rabbits were used for this experiment. The dorsum (backs) of all experimental animals were shaved on both right and left sides. Four areas were selected (two on each side) each one measuring approximately 6 cm in diameter. The anterior area was scarified using a sterile 18" G 1½ needle. Alcide gel was administered topically to six rabbits per group, in doses which contained the following amount of ClO_2^-: 18.9, 95.9, 180.1 and 421.9 mg kg^{-1}.

Gross signs of toxicity and mortality were recorded for 2 h and daily for 14 days after administration. Body weight was recorded initially, and at 7 and 14 days post dose. After 14 days, it was assumed that all survivors would continue to live.

Ocular irritation study. Nine albino rabbits were used for this experiment, and the animals were divided into three treatment groups. A single dose (100 mg) of Alcide gel was instilled into the conjunctival sac of the right eye of each animal in all groups. A single dose (100 mg) of placebo (a gel lacking the $NaClO_2$ and lactic acid) was instilled into the conjunctival sac of the left eye of one rabbit per level. The left eye of each of the two remaining rabbits per group was untreated to serve as control. The eyes of the first group were rinsed with lukewarm water (20 ml) at 10 s following instillation. The eyes of the second group were left unrinsed.

Readings of ocular reaction were conducted at 1, 24, 48, 72 h and at 4 and 7 days after treatment by using fluorescein and opthalmoscope for examination and the lesions graded according to the Draize method.[6]

Guinea pig sensitization study. *Liquid.* Five male albino Hartley guinea pigs were used for this experiment. The backs of all test animals were shaved. Alcide liquid was then injected intradermally at successive sites. Dosing was performed three times weekly for a total of ten applications. The first dose was 50 mg of Alcide which contained 0.32 mg ClO_2^- and 2.3 mg lactic acid. The remaining nine doses contained 100 mg Alcide.

Gel. Five male albino Hartley guinea pigs were used for this experiment. The backs of all test animals were shaved. Alcide gel was applied three times weekly for a total of ten applications. The first dose was 50 mg Alcide which contained 0.15 mg ClO_2^- and 1.32 mg lactic acid, while the other nine doses contained 100 mg Alcide.

Five male albino Hartley guinea pigs were used to serve as a control. Physiological saline (0.89%) was used for a total of ten applications, followed by a 14 day rest period. Saline, Alcide liquid and Alcide gel were then used for the challenge application. Daily observations were recorded for all test animals, noting gross signs of toxicity, mortality, general appearance and behavior. All animals were weighed on the first day of testing and 7 days thereafter.

Subchronic dermal toxicity. Thirteen male and 13 female albino rabbits (New Zeland White) were used for this experiment. Four areas were shaven on each rabbit's back, two on each side approximately 10 cm apart, two sites scarified and the others left intact. All animals were housed individually and were given food *ad libitum*.

Three dose levels with six animals (three per sex) at each level were used. The dosages of Alcide gel were 0.5, 1.0 and 2.0 gm kg^{-1}. Two animals were given 2.0 gm kg^{-1} of placebo (a gel that has no ClO_2^- and lactic acid).

Dermal exposures were administered daily for four consecutive weeks. Daily observations were conducted. Gross signs of toxicity and mortality were recorded.

Blood was collected in heparinized tubes by ear vein puncture after 15 days, and by cardiac puncture after 1 month of chronic treatment to determine the values of glutathione level,[7] osomotic fragility,[8] methemoglobin,[9] hematological parameters and blood chemistry. Coulter Model S was used to determine white blood cell count (WBC), red blood cell count (RBC), hemoglobin % (HGB), hematocrit % (HCT), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) in fresh heparinized blood from rabbits treated for 30 days.

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RESULTS AND DISCUSSION

Acute toxicity LD_{50} (oral)

Symptoms were first seen in the female group of rats which received a concentration of 207.5 mg kg^{-1}. Thirty minutes after administration, all animals appeared less active. After 24 h, they were normal, except for one which died within 48 h. Postmortem examination of this animal revealed that the lungs, liver, spleen and kidney were hyperemic. The male rats which received the 149.9 mg kg^{-1} dose showed no symptoms of toxicity, and all survived.

At the 250 mg kg^{-1} concentration level, the female rats appeared less active and showed signs of muscular incoordination during the first 2 h period. Twenty-four hours later they had all recovered, and appeared normal. On day 11, all female rats again appeared weak and began losing hair from the neck and flank areas. A decision was made to extend observation of this group for 2 weeks longer. Hair loss continued for 10 days; then animals gained their hair back completely 27 days after the administration. No mortality occurred in this group.

Male rats dosed at 180 mg kg^{-1} were less active during the first 2 h post-gavage. Thereafter, they were normal, and no mortality occurred.

Observations for the next two dosage levels (females: 312.5 and 356.3; males: 225 and 256.6 mg kg^{-1}) were the same except for the incidence of mortality. At the higher concentration, all male rats survived. However, two females died within 24 h post-gavage, and one died within 48 h.

Gross signs of toxicity were obvious in the animals receiving the next dose level (females: 425; males: 298.8 mg kg^{-1}). In the first 30 min, the females exhibited rapid abdominal respirations, and decreased activity. One died

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within the first 30 min, four more within 1.5 h, and the remaining three within 24 h.

The male rats were initially less severely affected, exhibiting the same calm movement observed at the previous dose level. However, three died within 2 h, and two more died within 24 h. By the second day, the two remaining animals appeared weak, and showed weight loss and a rough coat. Labored respirations were observed in one which died within 4 days. The last male died within 8 days.

On postmortem examination, male and female organs (liver, spleen, kidney and lung) were hyperemic, and blood vessels appeared darker.

At the highest dosage level (females: 625; males: 450 mg kg^{-1}), female and male groups showed similar signs of toxicity. Each group huddled in one corner of the cage, and showed rapid abdominal respirations, reacted slightly to stimuli and were drowsy.

On postmortem examination, liver, heart, kidney and lung tissues were hyperemic and blood vessels were engorged with dark blood.

From the mortality data (Tales 2 and 3), the LD_{50} was generated by probit analysis. For females, the values were 468, 357, 340 and 340 mg kg^{-1} for 2, 24, 48 h and 14 days, respectively. For males, the values were 424, 292, 292 and 292 mg kg^{-1} for the same time periods (Tables 4 and 5).

Weight gain, which occurred in both female and male groups, was significant on day 14 at the lower dose levels. However, as the doses increased, there was a reduced rate of gain during the two week test period (Tables 6 and 7). In the female group (250 mg kg^{-1}), which was observed an additional 2 weeks, all animals began to gain weight.

Acute dermal route. No mortality occurred during the acute dermal toxicity study. Also, no symptoms of toxicity were observed. However, in the 180.1 and 421.9 mg kg^{-1} groups the skin looked dry, but no other lesion was observed.

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Ocular irritation

The cornea, iris and conjunctiva were examined for signs of irritation or injury pre- and post-treatment. All animals' eyes were normal before testing.

Table 2. The effect of various doses[a] of Alcide experimental sterilant liquid administered orally to female rats

Group	Dose (mg kg^{-1})	Mortality after				
		n	2 h	24 h	48 h	14 days
1	25.0[b]	8	0	0	0	0
2	56.8	8	0	0	0	0
3	207.5	8	0	0	1	1
4	250.0	8	0	0	0	0
5	312.5	6	0	1	1	1
6	356.3	6	0	2	3	3
7	415.0	8	5	8	8	8
8	625.0	8	7	8	8	8

[a] Doses were derived from several dilutions of the highest concentration of Alcide (25-fold of the suggested use dilution strength).
[b] This dose represents the suggested strength for acne.

Table 3. The effect of various doses[a] of Alcide experimental sterilant liquid administered orally to male rats

Group	Dose (mg kg^{-1})	Mortality after				
		n	2 h	24 h	48 h	14 days
1	18.0[b]	8	0	0	0	0
2	40.9	8	0	0	0	0
3	149.4	8	0	0	0	0
4	180.0	7	0	0	0	0
5	225.0	6	0	1	1	1
6	256.5	6	0	0	0	0
7	298.8	8	3	5	5	8
8	450.0	8	4	8	8	8

[a] Doses were derived from several dilutions of the highest concentration of Alcide (25-fold of the suggested use dilution strength).
[b] This dose represents the suggested strength for acne.

Table 4. Oral LD_{50} in female rats treated with Alcide experimental liquid sterilant

	LD_{50}[a]			
	2 h	24 h	48 h	14 days
Dose (mg kg^{-1})	468	357	340	340
Range	(414–554)	(327–392)	(304–388)	(304–388)

[a] Values represent LD_{50} computed by probit analysis, and the range represents the lower and the upper values of the 95% fiducial limits.

Table 5. Oral LD_{50} in male rats treated with Alcide experimental liquid sterilant

	LD_{50}[a]			
	2 h	24 h	48 h	14 days
Dose (mg kg^{-1})	424	292	292	292
Range	(361–596)	(265–391)	(265–391)	(265–391)

[a] Values represent LD_{50} computed by probit analysis, and the range represents the lower and the upper values of the 95% fiducial limits.

Table 6. Effect of acute doses of Alcide experimental liquid sterilant on female rat body weight[a]

Dose (mg kg^{-1})		Test day		
	n	0	7	14
25.0[b]	8	172.4 ± 11.9	213.5 ± 13.2	224.3[c] ± 21.4
56.8	8	173.0 ± 13.9	216.8 ± 12.6	222.1[c] ± 20.9
207.5	8	175.9 ± 13.0	207.1 ± 22.4	207.7[c] ± 19.2
250.0	8	188.2 ± 16.9	196.4 ± 21.3	196.2 ± 25.2
312.5	6	198.3 ± 16.5	175.0 ± 27.6	187.0 ± 38.9
356.3	6	198.7 ± 17.1	175.0 ± 32.1	176.0 ± 48.0

[a] Values represent the mean and ± S.D. of the body weights (g) at indicated times.
[b] This dose represents the suggested strength for acne.
[c] Significantly different from 0 time, Student's *t*-test; $p < 0.001$.

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The cornea and iris remained normal during the observation period. However, the scores for the conjunctivae, after 1 h and 24 h post-treatment, were as follows:

Conjunctivae	1 h	24 h
Redness	2 ± 0	1 ± 0
Chemosis	0	0
Discharge	0	0
Score	4	2

Table 7. Effect of acute doses of Alcide experimental liquid sterilant on male rat body weight[a]

Dose (mg kg^{-1})		Test day		
	n	0	7	14
18.0[b]	8	235.0 ± 30.3	314.8 ± 42.2	351.6[c] ± 28.0
40.9	8	234.3 ± 25.7	347.1 ± 24.8	356.4[c] ± 17.1
149.4	8	238.0 ± 15.1	339.1 ± 27.9	338.4[c] ± 20.5
180.0	7	282.9 ± 31.6	316.6 ± 39.5	329.9[c] ± 41.2
225.0	6	275.7 ± 25.2	281.0 ± 22.2	308.0 ± 27.4
258.5	8	288.3 ± 16.8	257.0 ± 48.7	287.0 ± 57.7

[a] Values represent the mean and ±S.D. of the body weights (g) at indicated times.
[b] This dose represents the suggested strength for acne.
[c] Significantly different from 0 time, Student's *t*-test; $p < 0.001$.

Table 8. Effects of Alcide experimental sterilant on rabbit blood glutathione and osmotic fragility[a,b]

Treatment	15 days		30 days	
	GSH (mg %)	Hemolysis (%)	GSH (mg %)	Hemolysis (%)
Control	43.2 ± 5.4	74.7 ± 6.7	35.1 ± 4.9	67.7 ± 17.1
Placebo	ND[c]	ND	36.9 ± 2.1	62.7 ± 8.8
0.5 g kg^{-1}	48.1 ± 9.7	87.1 ± 5.0	33.4 ± 5.1	75.1 ± 13.1
1.0 g kg^{-1}	49.4 ± 6.5	71.6 ± 19.6	37.4 ± 4.4	46.1 ± 28.3
2.0 g kg^{-1}	41.0 ± 4.6	78.9 ± 10.9	36.8 ± 2.2	68.2 ± 15.4

[a] Values represent the mean and ±S.D. of glutathione level and % hemolysis for six animals per group.
[b] Methamoglobin was not detected in all test blood samples.
[c] ND = none determined.

Guinea pig sensitization

No sensitivity reaction was observed after the challenge dose of either Alcide liquid or gel. However, when Alcide liquid was administered, necrotic areas developed at the site of injection, which were possibly due to the low pH of the liquid. Therefore, citric acid was used to adjust saline to pH 2.7 (the same as Alcide liquid pH), then saline was administered to another group of guinea pigs as described in the Methods section. The result was identical to that seen in Alcide treatment.

Sub-chronic dermal toxicity

Physical examination revealed no mortality or changes on rabbit's skin during and after the experiment.

Glutathione, hemolysis and methemoglobin data indicated that Alcide experimental sterilant treatment had no effect in the sub-chronic dermal study (Table 8). Methemoglobin was not detected.

No significant changes were noted in experimental animals compared with controls in white blood cell count, red blood cell count, hemoglobin %, mean corpuscular volume and mean corpuscular hemoglobin. However, the hematocrit value was increased significantly, and the mean corpuscular hemoglobin concentration was decreased significantly in the 2.0 gm kg^{-1} group (Table 9).

Blood chemistry data revealed no significant differences between control and treatment groups, except in the 1.0 gm kg^{-1} group, creatinine and indirect bilirubin were higher and direct bilirubin was lower than controls. In the 2.0 gm kg^{-1} group, indirect bilirubin was high, direct bilirubin and albumin were lower than controls (Table 10).

Body weight data indicated that there was no significant difference in the rate of weight gain between treated and control groups. At the end of the experiment, postmortem examination revealed no abnormality or necrosis in any other organs. Also, no difference in organ:body ratios were observed between control and experimental groups after 30 days treatment (Table 11).

The present data revealed no Alcide toxicity at the recommended concentration to be used for treatment of acne and herpes. However, studies are currently in progress in our laboratory to further elucidate and characterize this new disinfectant in relationship to its toxicity after chronic treatment.

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Table 9. Effect of Alcide experimental sterilant on rabbit blood cell compartment after 30 days treatment[a]

Treatment	WBC	RBC	HGB	HCT	MCV	MCH	MCHC
Control	4.4 ± 0.9	5.4 ± 0.5	12.8 ± 0.8	35.5 ± 1.9	65.6 ± 2.8	23.7 ± 1.3	35.9 ± 0.7
0.5 g kg^{-1}	6.0 ± 1.8	5.6 ± 0.4	13.1 ± 1.0	36.5 ± 3.2	65.3 ± 1.9	23.6 ± 1.0	35.6 ± 1.2
1.0 g kg^{-1}	5.5 ± 0.8	5.6 ± 0.5	12.8 ± 0.6	37.4 ± 1.9	67.5 ± 3.7	23.1 ± 1.1	34.1 ± 1.5
2.0 g kg^{-1}	7.1 ± 2.5	5.8 ± 0.5	13.3 ± 0.5	39.1[b] ± 1.2	68.2 ± 5.0	23.0 ± 1.2	33.7[b] ± 0.5
Placebo	7.6 ± 3.2	5.6 ± 0.1	13.5 ± 0.4	37.7 ± 1.0	67.5 ± 0.7	24.1 ± 0.1	35.2 ± 0.1

[a] Values represent the mean and ±S.D. for six animals per group.
[b] Significantly different from control, Student's *t*-test; $p < 0.001$.

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Table 10. Effect of Alcide experimental sterilant on rabbit blood chemistry[a]

Test	Control	Placebo	0.5 (g kg^{-1})	1.0 (g kg^{-1})	2.0 (g kg^{-1})
Glucose (mg dl^{-1})	160.2±28.4	175.5±19.1	168.6±28.9	176.5±11.2	205.8±58.3
Urea nitrogen (mg dl^{-1})	14.0±4.2	13.0±0.0	19.0±4.2	17.5±3.6	17.2±3.1
Creatinine (mg dl^{-1})	1.15±0.10	1.00±0.00	1.13±0.21	1.42[b]±0.16	1.40±0.14
Sodium (meq l^{-1})	160.5±14.5	145.0±2.8	163.6±9.6	145.5±2.2	151.3±8.2
Potassium (meq l^{-1})	4.42±1.01	5.06±0.07	4.58±0.74	3.83±0.54	4.13±0.88
Chloride (meq l^{-1})	102.0±9.4	102.0±0.0	105.3±1.9	100.3±2.3	102.0±7.36
Carbon dioxide (meq l^{-1})	15.5±7.5	16.5±7.8	10.8±3.3	19.5±5.5	12.8±5.8
Uric acid (mg dl^{-1})	0.47±0.14	0.50±0.00	0.57±0.16	0.48±0.17	0.52±0.21
Calcium (mg dl^{-1})	15.3±1.9	15.5±1.6	15.1±1.3	14.2±0.8	14.7±1.1
Inorganic phosphorus (mg dl^{-1})	4.97±1.20	4.05±0.78	4.78±1.00	3.13±1.32	3.92±1.52
Bun/creatinine	12.4±4.4	13.0±0.0	17.8±5.2	12.5±3.6	13.4±1.5
Total protein (g dl^{-1})	5.75±0.26	5.70±0.42	6.25±0.58	5.83±0.33	5.65±0.48
Albumin (g dl^{-1})	4.40±0.27	4.20±0.42	4.45±0.42	4.02±0.24	3.83[b]±0.28
Alkaline phosphatase (U l^{-1})	146.2±52.6	135.0±25.5	137.0±17.5	78.0±23.0	110.3±52.3
Total bilirubin (mg dl^{-1})	0.17±0.05	0.20±0.00	0.20±0.06	0.25±0.08	0.22±0.04
Direct bilirubin (mg dl^{-1})	0.10±0.00	0.10±0.00	0.08±0.04	0.02[b]±0.04	0.02[b]±0.04
Cholesterol (mg dl^{-1})	54.0±22.8	53.5±20.5	52.0±17.7	42.8±10.4	46.6±19.7
SGOT (U l^{-1})	24.0±10.5	30.5±9.2	43.7±21.2	27.8±6.2	30.3±13.5
LDH (U l^{-1})	213.0±108.3	70.0±0.0	340.8±77.4	119.3±51.9	214.5±61.7
Indirect bilirubin	0.07±0.05	0.10±0.00	0.12±0.08	0.23[b]±0.10	0.22[b]±0.04
Balance	33.8±11.3	15.0±0.0	49.2±11.4	25.7±7.7	37.8±17.7

[a] Values represent the mean and ±S.D. for the analysis of the clinical chemistry in blood serum at the indicated dose levels.
[b] Significantly different from control, Student's *t*-test; $p < 0.001$.

Table 11. Effects of Alcide experimental sterilant on rabbit body and organ weights after 30 days

Treatment	Body weight	Liver weight ratio (%)	Spleen weight ratio (%)	Kidney weight ratio (%)	Testes weight ratio (%)
Control	3918.3[a]±245.0	3.0[b]±0.7	0.06±0.01	0.57±0.14	0.23±0.05
0.5 g kg^{-1}	3795.0±327.3	2.5±0.9	0.05±0.04	0.58±0.08	0.25±0.06
1.0 g kg^{-1}	3904.2±281.3	2.7±0.5	0.05±0.03	0.57±0.08	0.20±0.00
2.0 g kg^{-1}	3758.3±532.4	3.0±0.6	0.11±0.07	0.55±0.08	0.23±0.06

[a] Values represent the mean and ±S.D. of the body weight in grams.
[b] Values represent the percentage of the mean and ±S.D. of the ratio between the organ and the body weight.

REFERENCES

1. A. R. Shalita, Internal report from Department of Medicine, Division of Dermatology, Downstate Medical Center, State University of New York, May 1, 1979.
2. D. A. Baker, Internal report from Department of Obstetrics and Gynecology, School of Medicine, State University of New York at Stony Brook, Long Island, NY 11794, April 10, 1980.
3. H. Kitchen, Internal Report from Department of Environmental Practice, College of Veterinary Medicine, University of Tennessee, Knoxville, TN 37901, November 15, 1979.
4. W. P. Heffernan, C. Guion and R. Bull, Oxidative damage to the erythrocyte induced by sodium chlorite *in vivo*, *Environ. Pathol. Toxicol.* 2(6), 1487–1499 (1979).
5. M. S. Abdel-Rahman, D. Couri and R. Bull, Kinetics and effects of ClO_2, ClO_2^- and ClO_3^- in drinking water on blood glutathione and hemolysis in rat and chicken, *J. Env. Pathol. Toxicol.* 3, 431–449 (1979).
6. J. H. Draize, Appraisal of the safety of chemicals in foods, drugs and cosmetics. In *Dermal Toxicity*, 49–52, Association of Food and Drugs Officials of the US, Topeka, Kansas (1965).
7. E. Beutler, O. Doron and B. Kelly, Improved method for the determination of blood glutathione, *J. Lab. Clin. Med.* 61(5), 882–888 (1963).
8. J. V. Dacie, *Laboratory Medicine Hematology*, 5th Edn, ed. by J. B. Miale, pp. 1020–1021. C. V. Mosby, St. Louis, Mo. (1977).
9. K. A. Evelyn and H. T. Mallory, The determination of methemoglobin and sulfhemoglobin in a single sample of blood, *J. Biol. Chem.* 126, 655–663 (1938).

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